Transmission Constraint Penalty Factors - Reliability Impact

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Transmission Constraint Penalty Factors
These are parameters used by the Security Constrained Economic Dispatch (SCED) applications to determine the maximum cost of the re-dispatch incurred to control a transmission constraint.

- The transmission constraint penalty factor parameter is defined in $/MWh terms

- The ultimate effect of the Transmission Constraint Penalty Factors is to limit the controlling actions that can be taken to resolve a constraint by respecting the cost limits that the system is willing to incur to control it

- PJM internal constraints, regardless of voltage level, are defaulted to a $2,000/MWh transmission constraint penalty factor

  - Selected as the default value because historically most constraints can be effectively controlled at a cost below $2,000/MWh

- The transmission constraint penalty factor does not directly impact the shadow price of a constraint, as long as the constraint can be solved by resources whose effective costs are lower than the value of the penalty factor

Lowering TCPF Examples For Reliability

- Default TCPF can be raised or lowered <u>per individual constraint</u> to enable resources controlling a transmission constraint to set LMP. For purposes of reliability, the focus is on lowering.

- The tariff defines scenarios for adjustments:

  – Decrease: sufficient congestion relief on the constraint can be provided by available resources at a cost below the default TCPF in order to prevent a high cost resource that cannot provide material congestion relief on the constraint from inappropriately setting price for the constraint

PJM Tariff Attachment K, Section 5.6.3

- Prevent RTSCED from utilizing multiple resources with high effective cost and small material relief for the constraint:

  – Avoid ACE deviations or system control issues when moving large amount of generation

  – Can swing generators when SCED fails to control constraint (flow on constraint continues to increase in regard to respective limit)

- SCED is a Market Optimization Tool for Dispatching Resources

- Designed to maintain Power Balance based on input data while honoring Transmission Constraints
  - Load Forecast
  - Interchange

- ACE is <u>excluded</u> from SCED

- SCED receives State Estimator data from PJM EMS for Transmission Constraints.

- Congestion is controlled by dispatching resources up to TCPF

- When SCED cannot provide relief, TCPF is applied
  - Constraint may be worse due to system conditions or resource issues

Eastern Reactive Transfer Interface (IROL)

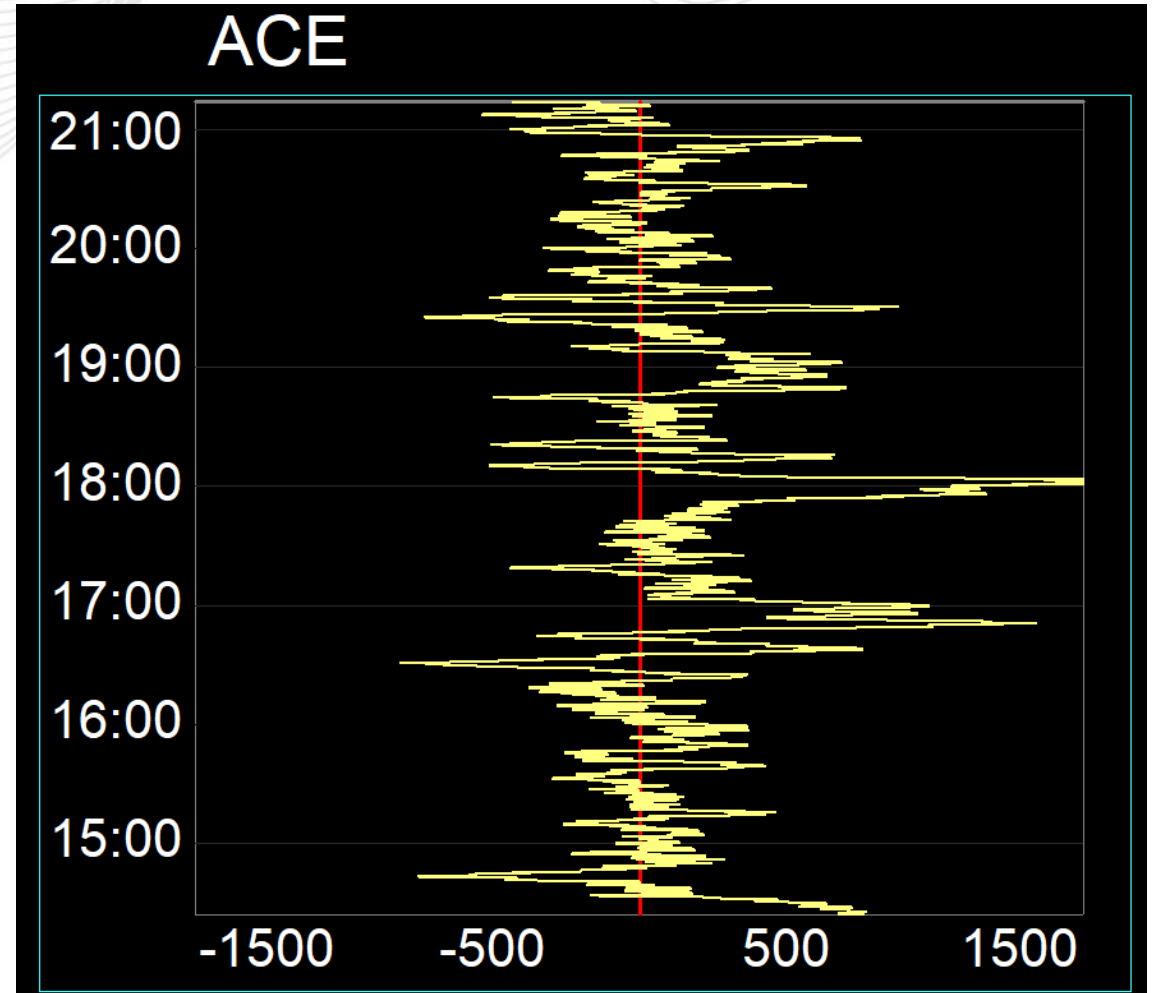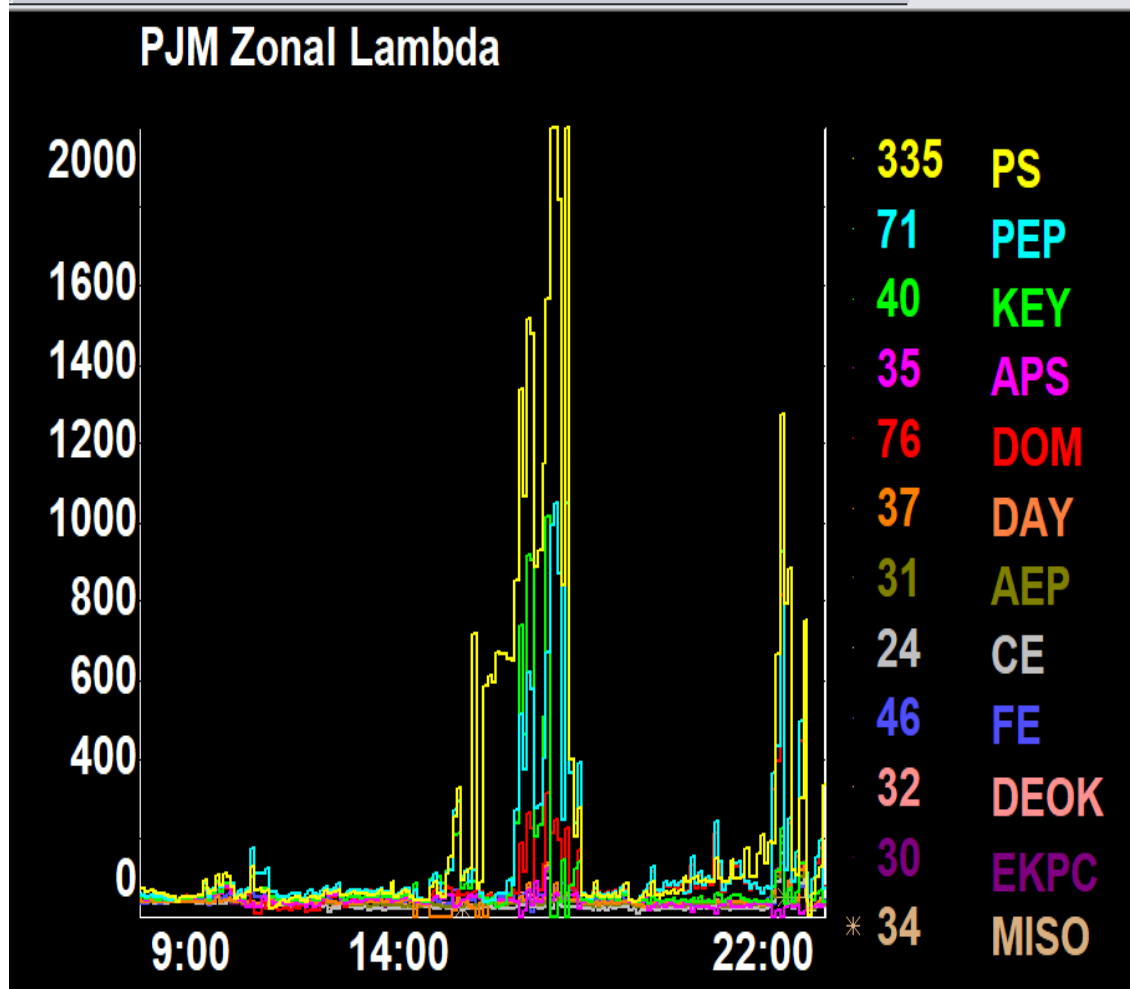Resources West of constraint reduced for Eastern Reactive Transfer Interface.

When Binding at TCPF to honor IROL Constraint, many units will reduce output based on SCED dispatch that does not consider ACE value.

Large Geograhic area impacted, many units impacted

Resources East of Contraint raised for Eastern Reactive Transfer Interface.

When Binding at TCPF, units will raise output based on SCED dipspatch that does not consider ACE value

Small Area impacted, few units impacted

PJM Zonal Lambda

335	PS
71	PEP
40	KEY
35	APS
76	DOM
37	DAY
31	AEP
24	CE
46	FE
32	DEOK
30	EKPC
34	MISO

ACE

10

- Limits amount of Resources impacted, allows additional generation to increase for ACE control (limits amount of bottled generation)

- Allows PJM Dispatch to manage constraints while honoring ACE

- Allows time for corrective actions
  - Notifying Resource Owners
  - Resource commitment in real time (CT dispatch)

- PJM posts all constraints where the default TCPF of $2,000/MWh is adjusted for Real-Time

    – https://dataminer2.pjm.com/feed/rt_default_mv_override

- PJM posts the Real-Time binding constraints and the TCPF value used

    – https://dataminer2.pjm.com/feed/rt_marginal_value

- PJM Tariff Attachment K, Section 5.6.3

- PJM Manual 11, Section 2.17: Applying Transmission Constraint Penalty Factors in the Market Clearing Engine

- White Paper – Marginal Value Limit Adjustments – 6/27/2018

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